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Period prevalence, risk factors and consequent injuries of falling among the Saudi elderly living in Riyadh, Saudi Arabia: A cross-sectional study

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ABSTRACT

Objectives: Approximately 28–35% of people aged 65 and over fall each year. The consequent injuries of falls are considered a major public health problem. Falls account for more than half of injury-related hospitalizations among elderly people. The aim of this study was to measure the prevalence of falling among elderly people in Riyadh, Saudi Arabia. In addition, this study described the most common risk factors and consequent injuries of falls.

Setting and participants: A cross-sectional survey was carried out in Riyadh, using a convenient sampling. The targeted population were Saudi citizens who were 60 years or above. Over a six-month period, 1,182 individuals were sampled (545 men and 637 women).

Results: 590 (49.9%) elderly Saudis have experienced one or more falls. Our results show that 74% of the participants who experienced falls had post-fall injuries. Elderly participants who were uneducated and those with middle school certification were associated with falls (aOR 1.72, aOR 1.81, respectively). Those who live in rented houses had a higher risk of falls. Interestingly, having a caregiver was significantly associated with more falls (aOR 1.39). However, not using any medications was significantly related to fewer falls. In addition, elderly individuals using walking aids were more likely to fall than those who did not. Participants who mentioned "not having stressors" were associated with less frequent falls (aOR 0.62; 95% CI 0.39 to 0.97). Cerebrovascular accidents (CVA) were strongly associated with falls with an estimated odds ratio of 2.75. Moreover, osteoporosis, poor vision, and back pain were found to be predictors for falls among the elderly.

Conclusion: Falls are common among older Saudi people. Several preventable risk factors could be addressed by routine geriatric assessment. Research on the impact of these risk factors is needed.

STRENGTHS AND LIMITATIONS OF THIS STUDY:

- Limited studies in middle east that discuss the geriatrics issues, specifically falls among this age category. To the best of our knowledge, this is the first study to be done about falls among elderly Saudis.
- As for Saudi Arabia, in 2012, there were 4.9% (1.4 million) of the Saudi population over the age of 60 years. This number is predicted to reach up to 21.8% (ten million) by 2050.
- We did not directly ask the elderly because of the difficulty with older people that the research team encountered during the piloting period.
- Some variables were not included in the analysis or listed in the DCF to avoid questionnaire fatigue for the participants, and thereby maintain a high retention rate.
- We included all falls during a 12-month period in this study, a period susceptible to a recall bias.

INTRODUCTION

There is no exact definition of the word "elderly" as this concept is perceived differently in different cultures and generations. An individual can be socially, economically, or chronologically viewed as elderly. The age of 60 years is used as the reference point for someone to be described as elderly by the United Nations.[1] In 2012, there were around 810 million elderly people alive worldwide; two-thirds of those were living in developing countries. It was postulated that this number will reach two billion by 2050. As for Saudi Arabia, in 2012, there were 4.9% (1.4 million) of the Saudi population over the age of 60 years. This same report predicted that this number will reach up to 21.8% (ten million) by 2050.[1]

Falls are defined as "inadvertently coming to rest on the ground, floor or other lower level, excluding intentional change in position to rest [on] furniture, walls or other objects."[2] Approximately 28–35% of people aged 65 and over fall each year.[2] The consequent injuries of falls are considered major public health problems. Falls account for more than half of injury-related hospitalizations among elderly people. The major underlying causes of hospital admissions include hip fractures, traumatic brain injuries, and upper limb injuries.[2] According to the United Nations Population Fund, around 20% of elderly people will die within a year following a hip fracture.[1] In addition, unintentional falls are the fifth leading cause of death in elderly people.[3]

Falls may lead to post-fall syndrome. Most elderly people who had previous falls have become dependent in terms of taking care of themselves and carrying out their daily activities.[1,4] This will surely affect the quality of life among those people in many respects. Moreover,

psychological problems are usually common in those who have previously fallen. Almost 70% of those patients will suffer from stress and basophobia, the fear of falls.[4]

A significantly increased risk of falling has been seen in elderly persons with diabetes and hypertension.[5] The risk is also significantly increased in those with lower limb weakness, balance/gait problems, dizziness, and visual disorders.[6,7] Education plays a big role in preventing or decreasing the incidence of falls, especially among elderly people. The level of education varies from one community to another. In Saudi Arabia, the population is dramatically increasing; currently, there are about 30 million people living in the kingdom.[8] This category of people should be educated about the most common risk factors and consequent injuries of falls. Unfortunately, the evidence of falls in older adults in developing countries, including Saudi Arabia, is sparse.[9]

The aim of this study was to measure the prevalence of falling among elderly people in Riyadh, Saudi Arabia. In addition, this study describes the most common risk factors and consequent injuries of falls. Identifying the risk factors of falls will add to our current knowledge about this particular subject, raise awareness, and provide for recommendations that will help in reducing the incidence of falls and thereby increase the quality of life among elderly people.

MATERIALS AND METHODS

Study design, study setting and subjects

This study was a cross-sectional study. The targeted population were Saudi citizens who were 60 years or above and live in the city of Riyadh, Saudi Arabia. Those who were unable to answer the questions and those with cognitive impairment were excluded from the study. During a six-month period from January to June 2016, 1,182 individuals were reached.

Data collection form

A data collection form (DCF) was developed as a tool for interviewing the participants. The DCF was pretested on a pilot sample to ensure that the survey was understood correctly by all respondents. The questions in the DCF were categorized into three sections: falling-related questions as remembered by the participant; health-related questions including acute and chronic diseases, number of medications and use of walking aids; and demographic questions including age, gender, educational level, income, source of support, marital status, house ownership, smoking, and exercise.

Sample size

The margin of error and confidence level were 3% and 95%, respectively. Likewise, the response distribution—which always provides the largest sample size—of prevalence of falls among the elderly was 50%. The minimum recommended size to meet this criterion was 1,014 participants. The sample size was calculated using Raosoft, Inc., an open source calculator.

Sampling technique

Each interview took approximately 5–15 minutes, depending on the participant's responses; a positive answer necessitated further inquiries. However, during piloting, when the research team tried to reach out to elderly people in public places and outpatient clinics, completion of the DCF was poor owing to the large number of questions. In addition, many individuals gave negative answers deliberately to prevent further inquiries. To overcome this limitation and generate results as accurately as possible, we created a digital version of the DCF and targeted a different category of people, namely, Saudis who were 18 years or above and had an elderly relative with the aforementioned inclusion criteria. The research team reached out to them in public places with one question: Do you have a relative 60 years of age or above who lives in Riyadh? If the answer was affirmative, and they were willing to participate, we asked for their names and contact information, and provided them with the following instructions. (A link of the DCF will be sent to you. Use it as a tool to direct the questions to your relative, the elderly person. You are merely an interviewer in this process. The answers to the questions found in the link must come from the elderly person only. Write your name as given to the research team member at the beginning of the DCF, so the source of your response can be identified and hence accepted. This link is for your personal use only. Do not send it to anyone unless you inform the research team member.) After completing the form, the interviewer was transferred to a web page with a specific code sent to the research team member. This protocol has been helpful in identifying responses from interviewers who might have entered a different variant of the name given to the research team member. To add to the accuracy measures, after a team member had contacted all the interviewers, their link was turned off and a new one created before continuing the sampling procedure with a further group.

Data management and analyses

The Statistical Package for the Social Sciences (SPSS, version 23) was used for data management and analysis. Descriptive statistics were used to assess the baseline demographics; they were carried out by calculating the frequencies and percentages comparing those who had a fall and those who had not. Prevalence was calculated with a 95% CI. Univariate and bivariate analyses of logistic regression were conducted to investigate risk factors related to falls. The model was run using all predictors at one time to obtain the odds ratio by adjusting for other predictors. The 95% CI, OR, and adjusted OR (aOR) were reported. All tests were considered significant if the *p* value was less than 0.05.

Ethical considerations

The study was approved by the Institutional Review Board (IRB), King Abdullah International Medical Research Centre (KAIMRC), Ministry of National Guard Health Affairs, Riyadh, Saudi Arabia. Participants were informed of their right to abstain from participation in the study or to withdraw their consent to participate at any time without reprisal. Data collection forms were accompanied by a cover letter explaining the purpose of the study and clearly stating that answers would be confidential and that anonymity would be guaranteed in the final reports.

RESULTS

Baseline characteristics of study participants

Over the study period from January to June 2016, 1,182 elderly people were interviewed by the research team. All of the participants were aged between 60 and 111 years (mean 68.8 ± 9.027 years, 69.13 ± 9.379 years for males and 67.68 ± 8.673 years for females). The proportion of males was almost equal to females with slightly more females (53.9%). Uneducated participants accounted for 36.3% and 30.7% had high school certification. Almost 64% were married, 32% were single or widowed, and the rest (5.5%) were separated. Only 9.6% of the sample were smokers. Of the participants, 43% said that they had a caregiver to help them in their activities. About two-thirds of the participants (64.9%) mentioned they were experiencing psychological stressors. Only 12% were using no medication while the majority (47%) were using four or more types of medication. Dependence on walking aids was not prevalent among the participants, 67.3% of whom were not using any walking aid. The socio-demographic characteristics for the participants are listed in Table 1.

Prevalence of falls over a 12-month period and falls-related characteristics

As Table 2 and Figure 1 show, 49.9% of elderly Saudis had experienced one or more falls during a 12-month period. Most of these individuals (312) had fallen once, 179 had fallen twice, 73 had fallen three times, and only 17 had fallen four times. Our results show that 74% of the participants who experienced falls had post-fall injuries. Ten percent of those injuries caused different types of fractures with leg fractures being accounting for 39% of total fractures, followed by hip and arm fractures (21% each). Furthermore, 48% of falls caused bruises. Of disk prolapse cases in those individuals, 5% were due to a fall. In addition, according to our results,

half of those who experienced a fall were unable to independently return to their previous position immediately after falling and 46% needed a walking aid. Regarding the place where the fall occurred, 77% had fallen in their homes, 15% in public places (mosques, streets, malls and elsewhere), and 8% in other places. Our results show that most falls occurred in bathrooms (35%) and at the front door step (20%). The rest took place in the kitchen, on stairs, in bedrooms and other places. Most of the falls occurred during the afternoon (30%), followed by 28% which occurred in the morning, 23% in the evening and 9% at night. Falling on their side occurred among 31% of individuals while 30% fell face down, 24% on their back, and 13% on their knees.

Forward stepwise univariate logistic regression analysis of the baseline characteristics' predictors of falls among elderly people

There was no association between age, gender, income, source of financial support, marital status, smoking or exercise, and experiencing a fall. Significantly, participants who were uneducated and those with middle school certification were associated with falls (aOR 1.72; 95% CI 1.15–2.56, aOR 1.81; 95% CI 1.15–2.85, respectively). Participants who lived in rented houses had a higher risk of falls than participants living in their own houses (aOR 1.56; 95% CI 1.02–2.37). Interestingly, having a caregiver was significantly associated with more falls (aOR 1.39; 95% CI 1.08–1.79). However, not using any medication was significantly related to fewer falls (aOR 0.60; 95% CI 0.41–0.90). In addition, elderly people who used walking aids were more likely to fall compared to those who did not. Those who used walkers or frames had significantly more than double the risk of falls (aOR 2.43; 95% CI 1.28–4.62) as did those who used walking sticks (aOR 1.54; 95% CI 1.15–2.05). Participants who mentioned "not having

stressors" were associated with less frequent falls (aOR 0.62; 95% CI 0.39–0.97). Table 3 summarizes the results of forward stepwise univariate logistic regression analysis of the predictors of falls among elderly people.

Forward stepwise univariate logistic regression analysis of the predictors of falls (diseases and conditions) among elderly people

Of participants in this study, 92% had one or more diseases. Diabetes (51.9%), hypertension (44.9%), poor vision (36.2%), and dyslipidemia (33.8%) were the most prevalent. Table 4 and Figure 1 detail the forward stepwise univariate logistic regression analysis of the predictors of falls (diseases and conditions) among the elderly. Cerebrovascular accident (CVA) was strongly associated with falls with an estimated odds ratio of 2.75 (95% CI 1.18–6.43). Moreover, osteoporosis, poor vision and back pain were found to be predictors for falls among elderly people (aOR 1.47, 95% CI 1.07–2.01; aOR 1.49, 95% CI 1.14–1.93; aOR 1.42, 95% CI 1.06–1.89, respectively).

DISCUSSION

Falls are common among the elderly worldwide with various factors increasing prevalence. Falls usually occur as a result of wide and diverse risk factors, as previous studies have shown.[10,11] Thus, it is important to know the risk factors contributing to these falls among the elderly living in Saudi Arabia. By investigating and addressing these risk factors, mortality, morbidity, hospital admission and reduced functionality will also be reduced among the elderly. The purpose of this study was to measure the prevalence of falling among elderly people and to identify the most common risk factors and consequent injuries of falls.

The present study reveals a high prevalence of at least one fall in the previous year among the Saudi elderly in Riyadh (49.9%). This is similar to a local study conducted by Alsaif et al. that showed 44.2% of elderly Saudis had a history of falls.[12] This 49.9% prevalence of falling is much higher than that reported in many countries: 28%, 34%, 37.4%, and 22% in England,[13] New Zealand,[14] Ecuador[15] and United States,[16] respectively. Interestingly, studies from Asian countries showed much lower prevalence rates than other countries: 11% in China,[17] 16% in Japan,[18] 19% in Hong Kong,[19] and only 4% in Malaysia.[20,21] In our region, the Middle East, little is known about how prevalent falling is among the elderly. One study conducted in Qatar showed that prevalence was almost the same as global studies (34%).[22] However, in Egypt, the prevalence of falls among the elderly was even higher than our findings (60.3%).[23]

In our sample, 47% of individuals who had experienced falls had fallen two or more times during the previous 12 months. Our findings were similar to those of an Italian study where 43.1% of the elderly who had fallen, had experienced more than one fall during a one-year period[24] and to an American study that showed a prevalence rate of 54%.[25] Previous findings found that fall-related injuries among the elderly ranged from 30.6% to 73.3%.[9,15,26] This range was not

matched in our study where more than 74% of those who had fallen had fall-related injuries. Of these individuals, 36% required more than a 24-hour hospital admission.

In the present study, indoor falls were the most common place of falling (83%), which is similar to the study of Yeong UY et al.[20] and a study conducted by E Almawlawi et al.[22] This was inconsistent with other studies that showed fewer indoor falls.[23,24] The Almawlawi et alfound that falls that occurred on the stairs were more common than those that occurred in the bathroom, which is the opposite of our findings. Moreover, 20% of participants in this study have fallen in a building outside of the house similar to another study conducted in Malaysia.[27]

There were inconsistent results regarding the effect of increasing age on the risk of falling. Many studies reported that falls increase with age.[28–30] In our study, increasing age was not significantly associated with falls among the elderly. Moreover, gender was not found to be a factor associated with falls, consistent with the findings of a previous study that found a greater association between musculoskeletal pain and trips or falls among the elderly in Japan;[18] in another study conducted in Germany, the fall rates increased with age in men but not women.[31] The opposite was found in Nigeria where females were more likely than males to report falls.[32] These different findings in different countries between elderly males and females could be related to unmeasured biological, social or environmental characteristics.

In comparison with a study undertaken by Kumar A et al.[33] regarding the effect of lower education levels on increased risk of falling, both studies showed that the risk increased among the uneducated elderly. Marital status, family income, and source of financial support were not found to be risk factors for falling among elderly people in our study. A study conducted on the risk factors of home injury among elderly people in Malaysia found that fewer married elderly people (4.9%) were likely to experience injuries at home than divorced/widowed (8%) or single

elderly people (8%).[21] Likewise, the same study reported findings that indicated differences in income do not increase the risk of falls.

Although some studies reported that the use of walking aids protected against falls,[34,35] our results, like previous reviews, showed that using a walking aid was associated with a doubled risk of falling among the elderly population.[10,11,36,37] In the present study, the likelihood of falling among the elderly was higher with poly-medication use. According to almost all studies, the risk of falls increases significantly if more than four medications are taken.[38] In the literature, stress as a risk factor for falling has not been widely reported. However, one study conducted in Korea found that a higher proportion of those who had fallen reported higher stress than those who had not fallen.[39] Similarly, our results showed that the elderly who reported "not having stress" had less risk of falls. As chronic stressors negatively affect physical and mental health, high stress levels surely lead to more falls, especially among elderly people.

Not surprisingly, participants with CVA in this study had a significantly higher risk of falls during a 12-month period. This is consistent with the conclusions of many systematic reviews that show a strong relationship between CVA and increased risk of falls among the elderly.[40,41] The current study also showed a significant association between osteoporosis and a high risk of falls. This finding agrees with a study conducted in the United Kingdom that showed an association between bone density and fall risk. The elderly who had good vision were less likely to experience falls than those with poor vision. This is similar to the findings from Sanjeev P et al., who found that the risk of falls among the elderly population has a linear relationship with poor vision.[42]

The present study is the first study in Riyadh to provide an estimation about the prevalence of falls among elderly Saudis and to look at the causes and risk factors underlying these falls.

However, this study has some limitations. One is that we did not directly ask the elderly because of the difficulty with older people that the research team encountered during the piloting period. Another is that we included all falls during a 12-month period in this study, a period susceptible to a recall bias. In addition, some variables were not included in the analysis or listed in the DCF to avoid questionnaire fatigue for the participants, and thereby maintain a high retention rate.

CONCLUSION

This study reveals that there is a high prevalence of falls among elderly Saudis in Riyadh. Falls among this age group are more common in Saudi Arabia than in several other countries. Educational level, housing ownership, presence of a caregiver, number of medications, use of walking aids and stress are associated with an increased risk of falling. Therefore, several preventable risk factors could be addressed by routine geriatric assessment. Increasing awareness about these factors and encouraging regular physical activities are strongly recommended.

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Contributor ship statement:

Faisal Alhusian, Ibrahim Alotaibi, and Faisal Almegbel designed the study, collected data and wrote the manuscript. Salma Alsalami, Amairah Aloushan, and Bashayer Almuqbil collected data and wrote the manuscript. Emad Masuadi analysed and interpreted data. Faisal Alhusain contributed to the interpretation of data.

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Table 1 – Demographic characteristics of the respondents and risk factors associated with falls among elderly Saudis

Variable	Category	Total		Falls			
				No		Yes	
		N	%	N	%	N	%
Age (Mean ±SD)	68.8 ± 9.027						
	Male: 69.13 ± 9.379						
	Female: 67.68 ± 8.673						
Gender	Male	545	46.1	288	52.8	257	47.2
	Female	637	53.9	304	47.7	333	52.3
Educational Level	Uneducated	429	36.3	187	43.6	242	56.4
	Primary school	241	20.4	126	52.3	115	47.7
	Middle school	149	12.6	68	45.6	81	54.4
	High school	163	13.8	88	54	75	46
	Diploma/Bachelor/Postgraduate	200	16.9	123	61.5	77	38.5
Marital Status	Married	752	63.6	385	51.2	367	48.8
	Single or widowed	378	32	184	48.7	194	51.3
	Separated	52	4.4	23	44.2	29	55.8
Monthly Family Income (SR)	Less than 5000	300	25.4	138	46	162	54
	5000–9999	350	29.6	173	49.4	177	50.6
	10000–19999	297	25.1	148	49.8	149	50.2
	More than 19999	235	19.9	133	56.6	102	43.4
Source of Financial Support	I support myself, my wife, and my children	364	30.8	203	55.8	161	44.2
	I support myself	325	27.5	143	44	182	56
	Someone else supports me	414	35	203	49	211	51
	I support myself and my wife	79	6.7	43	54.4	36	45.6
Housing Ownership	Owned	1069	90.4	545	51	524	49
	Rented	113	9.6	47	41.6	66	58.4
Having a Caregiver	No	671	56.8	365	54.4	306	45.6
	Yes	511	43.2	227	44.4	284	55.6
Use of Walking Aid	Do not use	795	67.3	431	54.2	364	45.8
	Walking stick	279	23.6	118	42.3	161	57.7
	Walker or frame	52	4.4	15	28.8	37	71.2
	Wheelchair	56	4.7	28	50	28	50
Use of Medications (Number)	Do not use any medications	145	12.3	88	60.7	57	39.3
	1–3	482	40.8	262	54.4	220	45.6
	4 or more	555	47	242	43.6	313	56.4
Stress	No stress	416	35.2	244	58.7	172	41.3
	Some	659	55.8	301	45.7	358	54.3
	Substantial	107	9.1	47	43.9	60	56.1
Cigarette Smoking	No	1069	90.4	533	49.9	536	50.1
	Yes	113	9.6	59	52.2	54	47.8
Exercise	No	824	69.7	393	47.7	431	52.3
	Yes	358	30.3	199	55.6	159	44.4

Table 2 – Prevalence of falls over a 12-month period and fall-related characteristics			
Variable	**Category**	**Total**	
		N	**%**
Experience any falls within last 12 months	Yes	590	49.9
	No	592	50.1
Number of fall(s) per person	1	312	52.9
	2	179	30.3
	3	73	12.4
	4	17	2.9
	5+	9	1.5
Fracture site	Hip	21	21
	Arm	21	21
	Rib	8	8
	Spine	9	9
	Leg	39	39
	Others	2	2
Place of falling	In own house	762	77
	In someone else's house/hotel/rest house	62	6
	Public place (mosques, mall, street, park)	146	15
	Other/Not specified	17	2
Place of falling in a house	Stairs	140	17
	Kitchen	64	9
	Front door step	168	20
	Bathroom	250	35
	Bedroom	116	14
	Other/Not specified	89	11
Place of falling in a public place	Mall	26	17
	Masjid	35	23
	Street	50	33
	Other/Not specified	99	66
Time of falling	Morning	277	28
	Afternoon	295	30
	Evening	229	23
	Can't remember/Not specified	192	20
Direction of falling	Side	308	31
	Knees	131	13
	On front	301	30
	Back	239	24
	Can't remember/Not specified	14	1

Table 3 – Forward stepwise univariate logistic regression analysis of the baseline characteristics' predictors of falls among the elderly

Variable	Category	*P* value	aOR**	95% C.I. for OR	
				Lower	Upper
Educational level	Uneducated	0.008	1.72	1.15	2.56
	Primary school	0.333	1.23	0.81	1.89
	Middle school	0.011	1.81	1.15	2.85
	High school	0.29	1.27	0.82	1.96
	Diploma/Bachelor/Postgraduate*		1		
Housing ownership	Rented	0.038	1.56	1.02	2.37
	Owned*		1		
Having a caregiver	Yes	0.011	1.39	1.08	1.79
	No*		1		
Use of medications (Number)	Do not use any medications	0.012	0.60	0.41	0.90
	1–3	0.012	0.72	0.55	0.93
	4 or more*		1		
Use of walking aid	Walking stick	0.004	1.54	1.15	2.05
	Walker or frame	0.007	2.43	1.28	4.62
	Wheelchair	0.865	1.05	0.59	1.86
	Do not use*		1		
Stress	No stress	0.036	0.62	0.39	0.97
	Some	0.942	1.02	0.66	1.57
	Substantial*		1		

* Reference group
** Adjusted odds ratio

Table 4 – Forward stepwise univariate logistic regression analysis of the predictors of falls (diseases and conditions) among the elderly

Disease	*P* value	aOR**	95% C.I. for OR	
			Lower	Upper
CVA*	0.019	2.75	1.18	6.43
Osteoporosis*	0.017	1.47	1.07	2.01
Poor Vision*	0.003	1.49	1.14	1.93
Back Pain*	0.018	1.42	1.06	1.89

* Not having the disease was the reference group
** Adjusted odds ratio

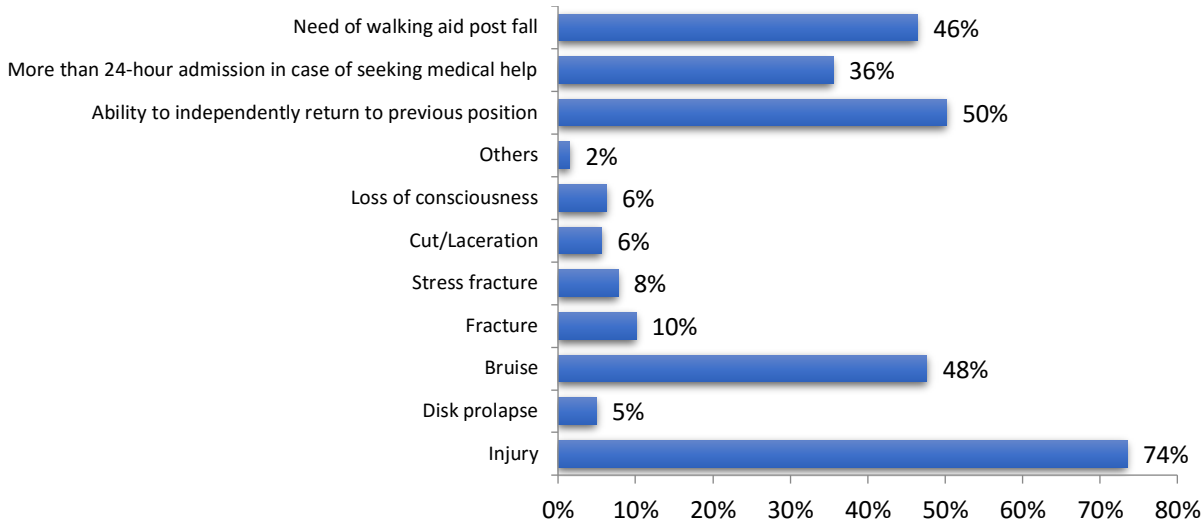

Figure 1: Consequent injuries of falling among elderly Saudis

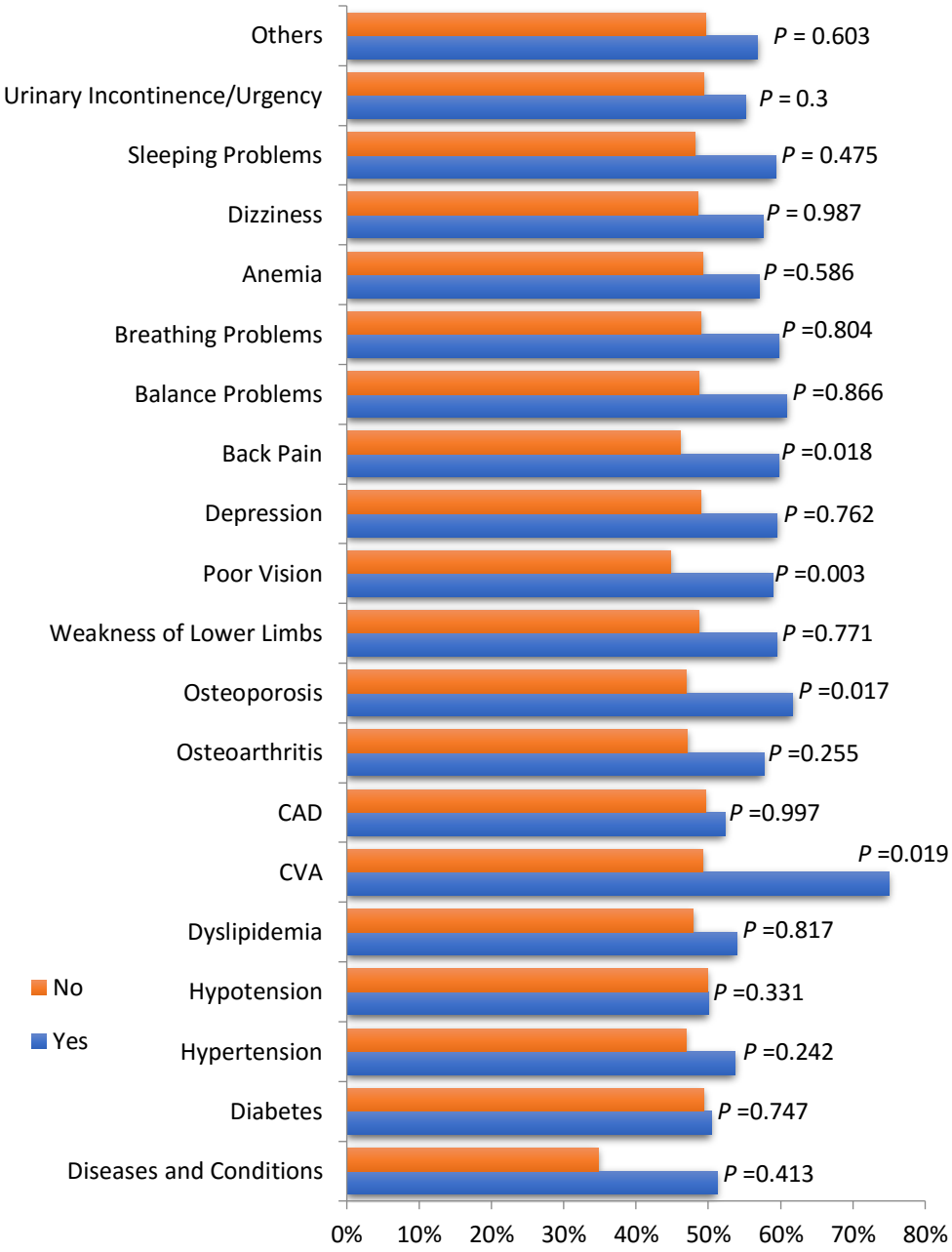

Figure 2: Prevalence of diseases and conditions among elderly Saudis who experienced falls and the relation with falling among the Saudi elderly. (*P* is from the univariate logistic regression analysis).

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1-2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	5-6
Methods			
Study design	4	Present key elements of study design early in the paper	7-8-9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8-9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7-8-9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-8-9
Bias	9	Describe any efforts to address potential sources of bias	7-8-9
Study size	10	Explain how the study size was arrived at	7-8-9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-8-9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7-8-9
		(*b*) Describe any methods used to examine subgroups and interactions	7-8-9
		(*c*) Explain how missing data were addressed	7-8-9
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	7-8-9
		(*e*) Describe any sensitivity analyses	7-8-9
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10-11-12
		(b) Give reasons for non-participation at each stage	10-11-12
		(c) Consider use of a flow diagram	10-11-12
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10-11-12
		(b) Indicate number of participants with missing data for each variable of interest	10-11-12
Outcome data	15*	Report numbers of outcome events or summary measures	10-11-12
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-11-12
		(*b*) Report category boundaries when continuous variables were categorized	10-11-12
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	10-11-12
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	10-11-12
Discussion			
Key results	18	Summarise key results with reference to study objectives	13-14-15-16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13-14-15-16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-14-15-16
Generalisability	21	Discuss the generalisability (external validity) of the study results	13-14-15-16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Period prevalence, risk factors and consequent injuries of falling among the Saudi elderly living in Riyadh, Saudi Arabia: A cross-sectional study

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Period prevalence, risk factors and consequent injuries of falling among the Saudi elderly living in Riyadh, Saudi Arabia: A cross-sectional study

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ABSTRACT

Objectives: Approximately 28–35% of people aged 65 and over fall each year. The consequent injuries of falls are considered a major public health problem. Falls account for more than half of injury-related hospitalizations among old people. The aim of this study was to measure a 1-year period prevalence of falling among old people in Riyadh, Saudi Arabia. In addition, this study described the most common risk factors and consequent injuries of falls.

Setting and participants: A cross-sectional survey was carried out in Riyadh, using a convenient sampling. The targeted population were Saudi citizens who were 60 years or above. Over a six-month period, 1,182 individuals were sampled (545 men and 637 women).

Results: The 1-year prevalence of falling among old Saudis (>= 60 years) was 49.9%. Our results show that 74% of the participants who experienced falls had post-fall injuries. Old participants who were uneducated and those with middle school certification were associated with falls (aOR 1.72; 95% CI 1.15 to 2.56, aOR 1.81; 95% CI 1.15 to 2.85, respectively). Those who live in rented houses had a higher risk of falls. Interestingly, having a caregiver was significantly associated with more falls (aOR 1.39; 95% CI 1.08 to 1.79). However, not using any medications was significantly related to fewer falls. In addition, old individuals using walking aids were more likely to fall than those who did not. Participants who mentioned “not having stressors” were associated with less frequent falls (aOR 0.62; 95% CI 0.39 to 0.97). Cerebrovascular accidents (CVA) were strongly associated with falls with an estimated odds ratio of 2.75 (95% CI 1.18 to 6.43). Moreover, osteoporosis, poor vision, and back pain were found to be predictors for falls among the elderly.

Conclusion: 49.9% of elderly Saudis had experienced one or more falls during a 12-month period. Several preventable risk factors could be addressed by routine geriatric assessment. Research on the impact of these risk factors is needed.

Keywords:
Elderly, Falls, Risk factors, Saudi Arabia

STRENGTHS AND LIMITATIONS OF THIS STUDY:

- Limited studies in middle east that discuss the geriatrics issues, specifically falls among this age category. To the best of our knowledge, this is the first study to be done about falls among elderly Saudis.
- We did not directly ask the elderly (the elderly was approached through their relatives) because of the difficulty with older people that the research team encountered during the piloting period.
- Some variables were not included in the analysis or listed in the DCF to avoid questionnaire fatigue for the participants, and thereby maintain a high retention rate.
- This is a cross-sectional study, in which we included all falls during a 12-month period, a period susceptible to a recall bias.
- Self-reported answers may be exaggerated and respondents may be too embarrassed to reveal private details; various biases may affect the results in this study.

INTRODUCTION

There is no exact definition of the word "elderly" as this concept is perceived differently in different cultures and generations. An individual can be socially, economically, or chronologically viewed as elderly. The age of 60 years is used as the reference point for someone to be described as elderly by the United Nations.[1] In 2012, there were around 810 million elderly people alive worldwide; two-thirds of those were living in developing countries. It was postulated that this number will reach two billion by 2050. As for Saudi Arabia, in 2012, there were 4.9% (1.4 million) of the Saudi population over the age of 60 years. This same report predicted that this number will reach up to 21.8% (ten million) by 2050.[1]

Falls are defined as "inadvertently coming to rest on the ground, floor or other lower level, excluding intentional change in position to rest [on] furniture, walls or other objects".[2] Approximately 28–35% of people aged 65 and over fall each year.[2] The consequent injuries of falls are considered major public health problems. Falls account for more than half of injury-related hospitalizations among elderly people. The major underlying causes of hospital admissions include hip fractures, traumatic brain injuries, and upper limb injuries.[2] According to the United Nations Population Fund, around 20% of elderly people will die within a year following a hip fracture.[1] In addition, unintentional falls are the fifth leading cause of death in elderly people.[3]

Falls may lead to post-fall syndrome.[4] Most elderly people who had previous falls have become dependent in terms of taking care of themselves and carrying out their daily activities.[1,5] This will surely affect the quality of life among those people in many respects. Moreover,

psychological problems are usually common in those who have previously fallen. Almost 70% of those patients will suffer from stress and the fear of not being able to stand and walk.[5]

A significantly increased risk of falling has been seen in elderly persons with diabetes and hypertension.[6] The risk is also significantly increased in those with lower limb weakness, balance/gait problems, dizziness, and visual disorders.[7,8] Education plays a big role in preventing or decreasing the incidence of falls, especially among elderly people. The level of education varies from one community to another. In Saudi Arabia, the population is dramatically increasing; currently, there are about 30 million people living in the kingdom.[9] This category of people should be educated about the most common risk factors and consequent injuries of falls. Unfortunately, the evidence of falls in older adults in developing countries, including Saudi Arabia, is sparse.[10]

The aim of this study was to measure the prevalence of falling among elderly people in Riyadh, Saudi Arabia. In addition, this study describes the most common risk factors and consequent injuries of falls. Identifying the risk factors of falls will add to our current knowledge about this particular subject, raise awareness, and provide for recommendations that will help in reducing the incidence of falls and thereby increase the quality of life among elderly people.

MATERIALS AND METHODS

Study design, study setting and subjects

This study was a cross-sectional study. The targeted population were Saudi citizens who were 60 years or above and live in the city of Riyadh, Saudi Arabia. Those who were unable to answer the questions and those with cognitive impairment were excluded from the study. During a six-month period from January to June 2016, 1,182 individuals were reached.

Data collection form

A data collection form (DCF) was developed as a tool for interviewing the participants. The DCF was pretested on a pilot sample to ensure that the survey was understood correctly by all respondents. The questions in the DCF were categorized into three sections: falling-related questions as remembered by the participant; health-related questions including acute and chronic diseases, number of medications and use of walking aids; and demographic questions including age, gender, educational level, income, source of support, marital status, house ownership, smoking, and exercise.

Sample size

The margin of error and confidence level were 3% and 95%, respectively. Likewise, the response distribution—which always provides the largest sample size—of prevalence of falls among the elderly was 50%. The minimum recommended size to meet this criterion was 1,014 participants. The sample size was calculated using Raosoft, Inc., an open source calculator.

Questionnaire piloting:

Each interview took approximately 5–15 minutes, depending on the participant's responses; a positive answer necessitated further inquiries. However, during piloting, when the research team

tried to reach out to elderly people in public places and outpatient clinics, completion of the DCF was poor owing to the large number of questions. In addition, many individuals gave negative answers deliberately to prevent further inquiries. To overcome this limitation and generate results as accurately as possible, we created a digital version of the DCF and targeted a different category of people, namely, Saudis who were 18 years or above and had an elderly relative with the aforementioned inclusion criteria.

Sampling technique

The research team reached out to them in public places with one question: Do you have a relative 60 years of age or above who lives in Riyadh? If the answer was affirmative, and they were willing to participate, we asked for their names and contact information, and provided them with the following instructions. (A link of the DCF will be sent to you. Use it as a tool to direct the questions to your relative, the elderly person. You are merely an interviewer in this process. The answers to the questions found in the link must come from the elderly person only. Write your name as given to the research team member at the beginning of the DCF, so the source of your response can be identified and hence accepted. This link is for your personal use only. Do not send it to anyone unless you inform the research team member.) After completing the form, the interviewer was transferred to a web page with a specific code sent to the research team member. This protocol has been helpful in identifying responses from interviewers who might have entered a different variant of the name given to the research team member. To add to the accuracy measures, after a team member had contacted all the interviewers, their link was turned off and a new one created before continuing the sampling procedure with a further group.

Data management and analyses

The Statistical Package for the Social Sciences (SPSS, version 23) was used for data management and analysis. Descriptive statistics were used to assess the baseline demographics; they were carried out by calculating the frequencies and percentages comparing those who had a fall and those who had not. Prevalence was calculated with a 95% CI. Univariate and bivariate analyses of logistic regression were conducted to investigate risk factors related to falls. The model was run using all predictors at one time to obtain the odds ratio by adjusting for other predictors. The 95% CI, OR, and adjusted OR (aOR) were reported. All tests were considered significant if the *p* value was less than 0.05.

Ethical considerations

The study was approved by the Institutional Review Board (IRB), King Abdullah International Medical Research Centre (KAIMRC), Ministry of National Guard Health Affairs, Riyadh, Saudi Arabia. Participants were informed of their right to abstain from participation in the study or to withdraw their consent to participate at any time without reprisal. Data collection forms were accompanied by a cover letter explaining the purpose of the study and clearly stating that answers would be confidential and that anonymity would be guaranteed in the final reports.

RESULTS

Baseline characteristics of study participants

Over the study period from January to June 2016, 1,182 elderly people were interviewed by the research team. All of the participants were aged between 60 and 111 years (mean 68.8 ± 9.0 years, 69.1 ± 9.4 years for males and 67.7 ± 8.7 years for females). The proportion of males was almost equal to females with slightly more females (53.9%, 647). Uneducated participants accounted for 36.3% (429) and 30.7% (363) had high school certification. Almost 64% (752) were married, 32% (378) were single or widowed, and the rest (4.4%, 52) were separated. Only 9.6% (113) of the sample were smokers. Of the participants, 43% (511) said that they had a caregiver to help them in their activities. About two-thirds of the participants (64.9%, 766) mentioned they were experiencing psychological stressors. Only 12% (145) were using no medication while the majority (47%, 555) were using four or more types of medication. Dependence on walking aids was not prevalent among the participants, 67% (795) of whom were not using any walking aid. The socio-demographic characteristics for the participants are listed in Table 1.

Prevalence of falls over a 12-month period and falls-related characteristics

As Table 2 and Figure 1 show, 49.9% (590) of elderly Saudis had experienced one or more falls during a 12-month period (among females 52%, 333, among males 47%, 257). Most of these individuals (53%, 312) had fallen once, 179 (30%) had fallen twice, 73 (12.4%) had fallen three times, and only 17 (2.9%) had fallen four times. Our results show that 74% of the participants who experienced falls had post-fall injuries. Ten percent of those injuries caused different types of fractures with leg fractures being accounting for 39% (39) of total fractures, followed by hip

and arm fractures (21% each, 21 each). Furthermore, 48% (283) of falls caused bruises. Of disk prolapse cases in those individuals, 5% were due to a fall. In addition, according to our results, half of those who experienced a fall were unable to independently return to their previous position immediately after falling and 46% needed a walking aid. Regarding the place where the fall occurred, 77% (762) had fallen in their homes, 15% (146) in public places (mosques, streets, malls and elsewhere), and 8% (79) in other places. Our results show that most falls occurred in bathrooms (35%, 250) and at the front door step (20%, 168). The rest took place in the kitchen, on stairs, in bedrooms and other places. Most of the falls occurred during the afternoon (30%, 295), followed by 28% (277) which occurred in the morning, and 23% (229) in the evening. Falling on their side occurred among 31% (308) of individuals while 30% (301) fell face down, 24% (239) on their back, and 13% (131) on their knees.

Forward stepwise univariate logistic regression analysis of the baseline characteristics' predictors of falls among elderly people

There was no association between age, gender, income, source of financial support, marital status, smoking or exercise, and experiencing a fall. Significantly, participants who were uneducated and those with middle school certification were associated with falls (aOR 1.72; 95% CI 1.15–2.56, aOR 1.81; 95% CI 1.15–2.85, respectively). Participants who lived in rented houses had a higher risk of falls than participants living in their own houses (aOR 1.56; 95% CI 1.02–2.37). Interestingly, having a caregiver was significantly associated with more falls (aOR 1.39; 95% CI 1.08–1.79). However, not using any medication was significantly related to fewer falls (aOR 0.60; 95% CI 0.41–0.90). In addition, elderly people who used walking aids were more likely to fall compared to those who did not. Those who used walkers or frames had

significantly more than double the risk of falls (aOR 2.43; 95% CI 1.28–4.62) as did those who used walking sticks (aOR 1.54; 95% CI 1.15–2.05). Participants who mentioned "not having stressors" were associated with less frequent falls (aOR 0.62; 95% CI 0.39–0.97). Table 3 summarizes the results of forward stepwise univariate logistic regression analysis of the predictors of falls among elderly people.

Forward stepwise univariate logistic regression analysis of the predictors of falls (co-morbidities and conditions) among elderly people

Of participants in this study, 92% had one or more co-morbidities. Diabetes (51.9%), hypertension (44.9%), poor vision (36.2%), and dyslipidemia (33.8%) were the most prevalent. Table 4 and Figure 2 detail the forward stepwise univariate logistic regression analysis of the predictors of falls (co-morbidities and conditions) among the elderly. Cerebrovascular accident (CVA) was strongly associated with falls with an estimated odds ratio of 2.75 (95% CI 1.18–6.43). Moreover, osteoporosis, poor vision and back pain were found to be predictors for falls among elderly people (aOR 1.47, 95% CI 1.07–2.01; aOR 1.49, 95% CI 1.14–1.93; aOR 1.42, 95% CI 1.06–1.89, respectively).

DISCUSSION

Falls are common among the elderly worldwide with various factors increasing prevalence. Falls usually occur as a result of wide and diverse risk factors, as previous studies have shown.[11,12] Thus, it is important to know the risk factors contributing to these falls among the elderly living in Saudi Arabia. By investigating and addressing these risk factors, mortality, morbidity, hospital admission and reduced functionality will also be reduced among the elderly. The purpose of this study was to measure the prevalence of falling among elderly people and to identify the most common risk factors and consequent injuries of falls.

The present study reveals a high prevalence of at least one fall in the previous year among the Saudi elderly in Riyadh (49.9%). This is similar to a local study conducted by Alsaif et al. that showed 44.2% of elderly Saudis had a history of falls.[13] This 49.9% prevalence of falling is much higher than that reported in many countries: 28%, 34%, 37.4%, and 22% in England,[14] Canada,[15] Ecuador[16] and United States,[17] respectively. Interestingly, studies from Asian countries showed much lower prevalence rates than other countries: 11% in China,[18] 16% in Japan,[19] 19% in Hong Kong,[20] and only 4% in Malaysia.[21,22] In our region, the Middle East, little is known about how prevalent falling is among the elderly. One study conducted in Qatar showed that prevalence was almost the same as global studies (34%).[23] However, in Egypt, the prevalence of falls among the elderly was even higher than our findings (60.3%).[24] These differences between countries could be related to different ethnicity and culture related factors that could play roles in falling among old people. In our sample, 47% of individuals who had experienced falls had fallen two or more times during the previous 12 months. Our findings were similar to those of an Italian study where 43.1% of the elderly who had fallen, had experienced more than one fall during a one-year period[25] and to an American study that showed a prevalence rate of 54%.[26]

Previous findings found that fall-related injuries among the elderly ranged from 30.6% to 73.3%.[10,16,27] This range was not matched in our study where more than 74% of those who had fallen had fall-related injuries. Of these individuals, 36% required more than a 24-hour hospital admission.

In the present study, indoor falls were the most common place of falling (83%), which is similar to the study of Yeong UY et al.[21] and a study conducted by Almawlawi et al.[23] This was inconsistent with other studies that showed fewer indoor falls.[24,25] The Almawlawi et al found that falls that occurred on the stairs were more common than those that occurred in the bathroom, which is the opposite of our findings. Moreover, 20% of participants in this study have fallen in a building outside of the house similar to another study conducted in Malaysia.[21]

There were inconsistent results regarding the effect of increasing age on the risk of falling. Many studies reported that falls increase with age.[28–30] In our study, increasing age was not significantly associated with falls among the elderly. Moreover, gender was not found to be a factor associated with falls, consistent with the findings of a previous study that found a greater association between musculoskeletal pain and trips or falls among the elderly in Japan;[19] in another study conducted in Germany, the fall rates increased with age in men but not women.[31] The opposite was found in Nigeria where females were more likely than males to report falls.[32] These different findings in different countries between elderly males and females could be related to unmeasured biological, social or environmental characteristics.

In comparison with a study undertaken by Kumar A et al.[33] regarding the effect of lower education levels on increased risk of falling, both studies showed that the risk increased among the uneducated elderly. Marital status, family income, and source of financial support were not found to be risk factors for falling among elderly people in our study. A study conducted on the

risk factors of home injury among elderly people in Malaysia found that fewer married elderly people (4.9%) were likely to experience injuries at home than divorced/widowed (8%) or single elderly people (8%).[22] Likewise, the same study reported findings that indicated differences in income do not increase the risk of falls.

Although some studies reported that the use of walking aids protected against falls,[34,35] our results, like previous reviews, showed that using a walking aid was associated with a doubled risk of falling among the elderly population.[11,12,36,37] In the present study, the likelihood of falling among the elderly was higher with poly-medication use. According to almost all studies, the risk of falls increases significantly if more than four medications are taken.[38] In the literature, stress as a risk factor for falling has not been widely reported. However, one study conducted in Korea found that a higher proportion of those who had fallen reported higher stress than those who had not fallen.[39] Similarly, our results showed that the elderly who reported "not having stress" had less risk of falls. As chronic stressors negatively affect physical and mental health, high stress levels surely lead to more falls, especially among elderly people.

Not surprisingly, participants with CVA in this study had a significantly higher risk of falls during a 12-month period. This is consistent with the conclusions of many systematic reviews that show a strong relationship between CVA and increased risk of falls among the elderly.[40,41] The current study also showed a significant association between osteoporosis and a high risk of falls. This finding agrees with a study conducted in the United Kingdom that showed an association between bone density and fall risk. The elderly who had good vision were less likely to experience falls than those with poor vision. This is similar to the findings from Sanjeev P et al., who found that the risk of falls among the elderly population has a linear relationship with poor vision.[42]

The present study is the first study in Riyadh to provide an estimation about the prevalence of falls among elderly Saudis and to look at the causes and risk factors underlying these falls. However, this study has some limitations. One is that we did not directly ask the elderly because of the difficulty with older people that the research team encountered during the piloting period. Another is that we included all falls during a 12-month period in this study, a period susceptible to a recall bias. In addition, some variables (type of exercise, lift availability, self-evaluation of self-health, vitamin D supplementation, and previous specific type of surgeries) were not included in the analysis or listed in the DCF to avoid questionnaire fatigue for the participants, and thereby maintain a high retention rate. Self-reported answers may be exaggerated and respondents may be too embarrassed to reveal private details; various biases may affect the results in this study.

CONCLUSION

This study reveals that there is a high prevalence of falls among elderly Saudis in Riyadh. Falls among this age group are more common in Saudi Arabia than in several other countries. Educational level, housing ownership, presence of a caregiver, number of medications, use of walking aids and stress are associated with an increased risk of falling. Therefore, several preventable risk factors could be addressed by routine geriatric assessment. Increasing awareness about these factors and encouraging regular physical activities are strongly recommended.

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Contributor ship statement:

Faisal Alhusian, Ibrahim Alotaibi, and Faisal Almegbel designed the study, collected data and wrote the manuscript. Salma Alsalami, Amairah Aloushan, and Bashayer Almuqbil collected data and wrote the manuscript. Emad Masuadi analysed and interpreted data. Faisal Alhusain contributed to the interpretation of data.

Competing interests: None declared.

Funding: None

Data sharing statement: No additional data are available.

Table 1 – Demographic characteristics of the respondents and risk factors associated with falls among elderly Saudis

Variable	Category	Total		Falls			
				No		Yes	
		N	%	N	%	N	%
Age (Mean ±SD)	68.8 ± 9.027						
	Male: 69.13 ± 9.379						
	Female: 67.68 ± 8.673						
Gender	Male	545	46.1	288	52.8	257	47.2
	Female	637	53.9	304	47.7	333	52.3
Educational Level	Uneducated	429	36.3	187	43.6	242	56.4
	Primary school	241	20.4	126	52.3	115	47.7
	Middle school	149	12.6	68	45.6	81	54.4
	High school	163	13.8	88	54	75	46
	Diploma/Bachelor/Postgraduate	200	16.9	123	61.5	77	38.5
Marital Status	Married	752	63.6	385	51.2	367	48.8
	Single or widowed	378	32	184	48.7	194	51.3
	Separated	52	4.4	23	44.2	29	55.8
Monthly Family Income (SR)	Less than 5000	300	25.4	138	46	162	54
	5000–9999	350	29.6	173	49.4	177	50.6
	10000–19999	297	25.1	148	49.8	149	50.2
	More than 19999	235	19.9	133	56.6	102	43.4
Source of Financial Support	I support myself, my wife, and my children	364	30.8	203	55.8	161	44.2
	I support myself	325	27.5	143	44	182	56
	Someone else supports me	414	35	203	49	211	51
	I support myself and my wife	79	6.7	43	54.4	36	45.6
Housing Ownership	Owned	1069	90.4	545	51	524	49
	Rented	113	9.6	47	41.6	66	58.4
Having a Caregiver	No	671	56.8	365	54.4	306	45.6
	Yes	511	43.2	227	44.4	284	55.6
Use of Walking Aid	Do not use	795	67.3	431	54.2	364	45.8
	Walking stick	279	23.6	118	42.3	161	57.7
	Walker or frame	52	4.4	15	28.8	37	71.2
	Wheelchair	56	4.7	28	50	28	50
Use of Medications (Number)	Do not use any medications	145	12.3	88	60.7	57	39.3
	1–3	482	40.8	262	54.4	220	45.6
	4 or more	555	47	242	43.6	313	56.4
Stress	No stress	416	35.2	244	58.7	172	41.3
	Some	659	55.8	301	45.7	358	54.3
	Substantial	107	9.1	47	43.9	60	56.1
Cigarette Smoking	No	1069	90.4	533	49.9	536	50.1
	Yes	113	9.6	59	52.2	54	47.8
Exercise	No	824	69.7	393	47.7	431	52.3
	Yes	358	30.3	199	55.6	159	44.4

Table 2 – Prevalence of falls over a 12-month period and fall-related characteristics			
Variable	**Category**	**Total**	
		N	**%**
Experience any falls within last 12 months	Yes	590	49.9
	No	592	50.1
Number of fall(s) per person	1	312	52.9
	2	179	30.3
	3	73	12.4
	4	17	2.9
	5+	9	1.5
Fracture site	Hip	21	21
	Arm	21	21
	Rib	8	8
	Spine	9	9
	Leg	39	39
	Others	2	2
Place of falling	In own house	762	77
	In someone else's house/hotel/rest house	62	6
	Public place (mosques, mall, street, park)	146	15
	Other/Not specified	17	2
Place of falling in a house	Stairs	140	17
	Kitchen	64	9
	Front door step	168	20
	Bathroom	250	35
	Bedroom	116	14
	Other/Not specified	89	11
Place of falling in a public place	Mall	26	17
	Masjid	35	23
	Street	50	33
	Other/Not specified	99	66
Time of falling	Morning	277	28
	Afternoon	295	30
	Evening	229	23
	Can't remember/Not specified	192	20
Direction of falling	Side	308	31
	Knees	131	13
	On front	301	30
	Back	239	24
	Can't remember/Not specified	14	1

Table 3 – Forward stepwise univariate logistic regression analysis of the baseline characteristics' predictors of falls among the elderly

Variable	Category	*P* value	aOR**	95% C.I. for OR	
				Lower	Upper
Educational level	Uneducated	0.008	1.72	1.15	2.56
	Primary school	0.333	1.23	0.81	1.89
	Middle school	0.011	1.81	1.15	2.85
	High school	0.29	1.27	0.82	1.96
	Diploma/Bachelor/Postgraduate*		1		
Housing ownership	Rented	0.038	1.56	1.02	2.37
	Owned*		1		
Having a caregiver	Yes	0.011	1.39	1.08	1.79
	No*		1		
Use of medications (Number)	Do not use any medications	0.012	0.60	0.41	0.90
	1–3	0.012	0.72	0.55	0.93
	4 or more*		1		
Use of walking aid	Walking stick	0.004	1.54	1.15	2.05
	Walker or frame	0.007	2.43	1.28	4.62
	Wheelchair	0.865	1.05	0.59	1.86
	Do not use*		1		
Stress	No stress	0.036	0.62	0.39	0.97
	Some	0.942	1.02	0.66	1.57
	Substantial*		1		

* Reference group
** Adjusted odds ratio

Table 4 – Forward stepwise univariate logistic regression analysis of the predictors of falls (co-morbidities and conditions) among the elderly				
co-morbidity	*P* value	aOR**	95% C.I. for OR	
			Lower	Upper
CVA*	0.019	2.75	1.18	6.43
Osteoporosis*	0.017	1.47	1.07	2.01
Poor Vision*	0.003	1.49	1.14	1.93
Back Pain*	0.018	1.42	1.06	1.89

* Not having the co-morbidity was the reference group
** Adjusted odds ratio

Figure 1: Consequent injuries of falling among elderly Saudis

Figure 2: Prevalence of diseases and conditions among elderly Saudis who experienced falls and the relation with falling among the Saudi elderly. (P is from the univariate logistic regression analysis).

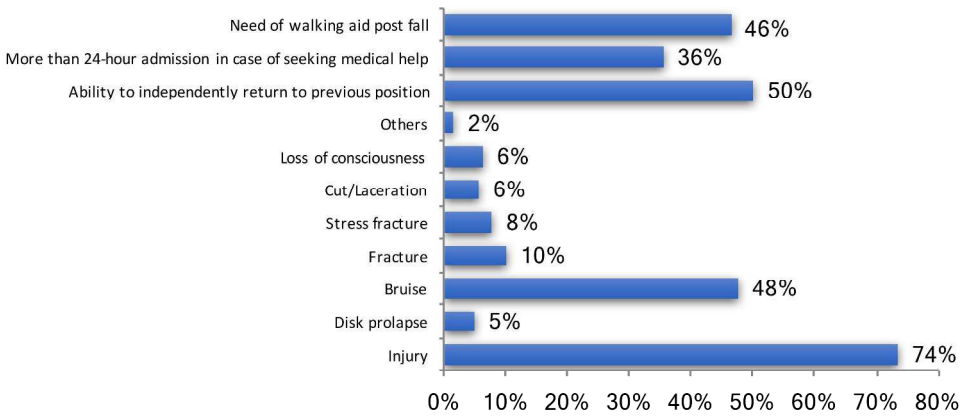

Figure 1: Consequent injuries of falling among elderly Saudis

297x134mm (300 x 300 DPI)

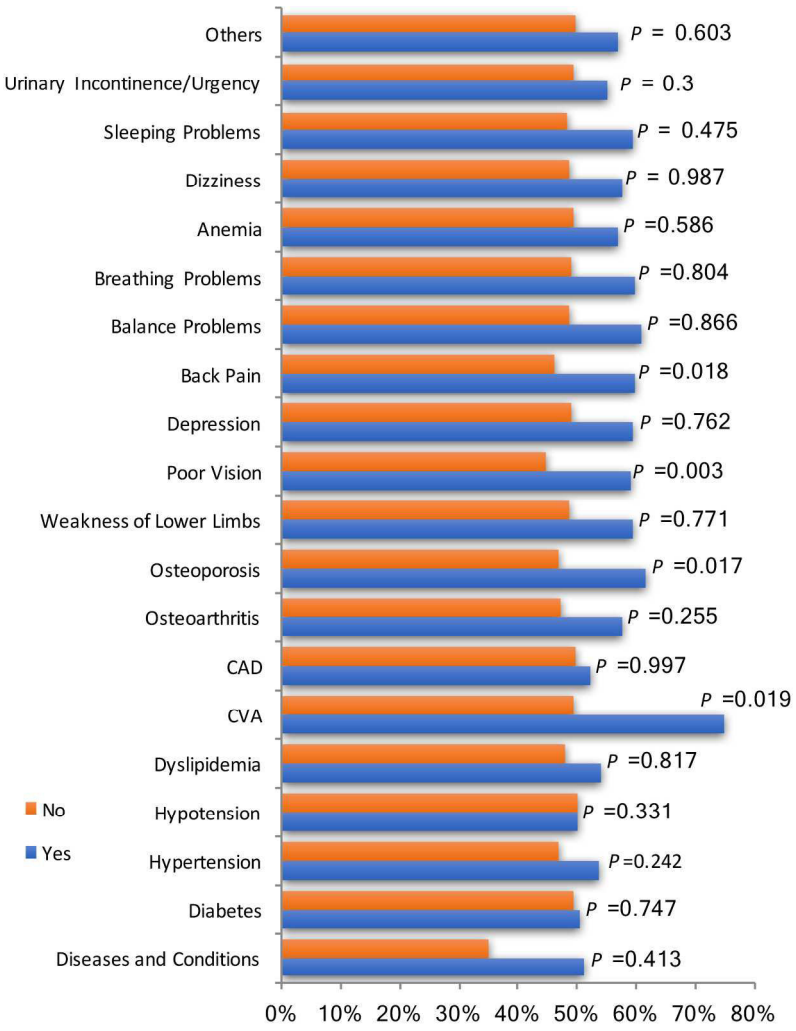

Figure 2: Prevalence of comorbidities and conditions among elderly Saudis who experienced falls and the relation with falling among the Saudi elderly. (*P* is from the univariate logistic regression analysis).

209x241mm (300 x 300 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	In the title and abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	In the 2nd and 3rd pages
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	In the 5th and 6th pages
Objectives	3	State specific objectives, including any prespecified hypotheses	Last paragraph in the introduction
Methods			
Study design	4	Present key elements of study design early in the paper	Under Study design, study setting and subjects, page 7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Under Study design, study setting and subjects page 7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	Under Study design, study setting and subjects page 7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Under Study design, study setting and subjects page 7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	N/A
Bias	9	Describe any efforts to address potential sources of bias	Under questionnaire piloting and Sampling technique

Study size	10	Explain how the study size was arrived at	Sample size
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Under data management and analyses
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Under data management and analyses
		(*b*) Describe any methods used to examine subgroups and interactions	Under data management and analyses
		(*c*) Explain how missing data were addressed	Under data management and analyses
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	Under data management and analyses
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Under baseline characteristics of study participants, first line
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Under baseline characteristics of study participants
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	N/A
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	In the result part

		(*b*) Report category boundaries when continuous variables were categorized	Under baseline characteristics of study participants
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	First 6 lines in the 2nd paragraph
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	At the end in the discussion part
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Through the discussion
Generalisability	21	Discuss the generalisability (external validity) of the study results	N/A
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.